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Prototype of Integrated Pier Entrance Gate Access With QR-Code as An Iot-Based Manifest Recording System

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ABSTRACT

The pier is the place where the ships are being moored at the port. It is also a place for loading and unloading activities and for people or passengers to get on or get off from the ships. There is a need for a digital recording of vehicles or passengers entering the ships to speed up the port administration process. For this reason, in this study, a prototype of a Vehicle and Passenger Recording System (Manifest) at the dock access gate is integrated in an integrated manner based on the Internet of Thing (IoT), which consists of an Android and Web system. This system uses a QR-Code as a ticket that contains manifest data and is read with a QR-Code Reader to be compared with the data stored in the server. If it is appropriate, the dock entrance will be active, and the vehicles or passengers can enter the ships. Whereas if it does not fit, they cannot be open the pier access door. From the test results, the mechanical system can function as expected and can recognize as the entire QR-Code within an optimal distance of 3 cm. All registered users can open the door, as well.

Keywords: Pier, Integrated, Manifest, QR-Code, IoT

Introduction

Ships as a means of transportation that connects adjacent islands and connects large islands, the role of sea transportation are very vital (Grydehøj & Casagrande, 2020); Therefore, an adequate ferry fleet is needed so that later it can facilitate the flow of goods and passengers from one area to another (Mantong et al., 2020). Several shipping companies provide transportation services by ship, provide ferry transportation services, and management of ferry ports for passengers (Clifford R., 2018). At the time of loading activities, found several problems, one of which was the application of the loading procedure that was running inappropriately, field officers who often recorded vehicle manifest, passenger data, and complete documents to be submitted to the harbormaster did not match the actual passenger and vehicle, as well as the presence of officers in the field who pick up cargo that is not suitable for loading on the ship so that it interferes with safety, the application of lashing to heavy loads such as trucks that are too rushed due to short loading hours (Hang Leung, 2016; Smallwood, 2018).

For this reason, in this study, a management system for managing passenger manifest records was created, by setting up a management system at the port gate and dock gate, by utilizing QR-Code to open port latches and dock latches, as well as to record passenger manifest.

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Several studies related to passenger manifest management, among others by (Hamid et al., 2018) developed and implemented a QR-Code-based automatic gate system, and this system was designed and manufactured with a PIR motion sensor, servo motor, Arduino microcontroller, Piezo buzzer, and camera. The software is implemented using VB.NET, and the QR recognition rate is about 99% accurate, but the results of this study are only on the process of registering and opening the barrier gate with QR-Code, it does not discuss further data management. Future researchers (Tanmay Satpalkar et al., 2016) implemented a system that allows drivers to book and find parking slots online. In this system, the driver can reserve parking slots in a specific zone, check for empty slots, and order them according to the needs of the vehicle. Next, a QR code is generated, which encodes the unique details of the user. QR codes are used for encryption and to facilitate the authentication process. This system does not explain the backhand management process.

Reference by (Siew et al., 2016) is implementing a QR-code on a parking system and running on a mobile platform, and providing a visual display of available parking spaces for users so that users can book or reserve the space, thereby reducing the time it takes to find a parking space; however a data processing system that is stored in the database has not yet been established, such as making reports and others. In comparison, the reference by (James & Abraham, 2018) is a car parking system with a Smart System that is integrated with the Android application and QR Code reader. This smart parking system is to find out information about the occupancy status of the parking IoT and inform the driver of the nearest empty parking lot, QR Code is only used to open the gate, it does not contain any other information.

From several studies above, the use of QR-Code is only used as a tool to open or close, there is no other advanced function, in this study, QR-Code is also used for barrier gate opening systems, namely port entrances for payment processing and dock entrances, whose primary function of this QR-Code is for the process of registering vehicles and passengers (manifest), so that it will make it easier for the harbormaster to make a ship pass for sailing. This system is called the V-MISSQ-Port (Vehicle and Passenger Management Information System Base on QR-Code, at the Port), created using an android application on the side of users and field officers, and web-based for administrators in the administration room. The software used is based on IoT by using several types of equipment, including QR-Code and reader, camera, wmos, and other equipment. So that with this system it is expected to save time in loading and unloading services at the port.

Material and Methods

Before designing and making the V-MISSQ-Port, a survey was conducted to determine the work system for managing the manifest that will enter the ship, including:

1. Vehicles or passengers who will cross come to the port entrance area to buy tickets.
2. When the vehicle or passenger is in the entrance area, the officer will record the manual number of the vehicle's police crossing and passenger data in the manifest form.
3. After the officer's record passenger data and vehicle police numbers, passengers make ticket purchases and can immediately queue at the pier.
4. After the vehicle or passengers arrive at the dock, the officers at the dock check the manifest form of passengers who will enter the ship to be given to the administrator as a condition for issuing SPB (The warrant for sailing).

From the above process, several stages of development are needed, among others BIC (Barrier in Control) or CTU (Control Terminal Unit), CMC (Central Management Control), AAP (Android-Ios Personal Application), QR-Code Support Tools, and (WSA) Web Service Application, but in this paper only discusses the role of QR-Code in the process of managing vehicles and passengers (manifest) entering the ship. The V-MISSQ-Port is integrated, as shown in Figure 1.

In Figure 1. V-MISSQ-Port design that all passengers or vehicles that will cross from the Ketapang-Gilimanuk port must first register with the android system that has been provided. Then the passenger checks the ship's timetable for crossing. If the schedule is available, the passenger must enter the passenger and vehicle data used in the manifest on the Android system. After entering the manifest data into the android system, passengers will get a QR-Barcode to enter the parking area of the Ketapang-Gilimanuk port. If a passenger or vehicle enters the dock, the field officer will perform the QR-Barcode, to convey the vehicle or passenger data to the administrator, so that the administrator issues the SPB.

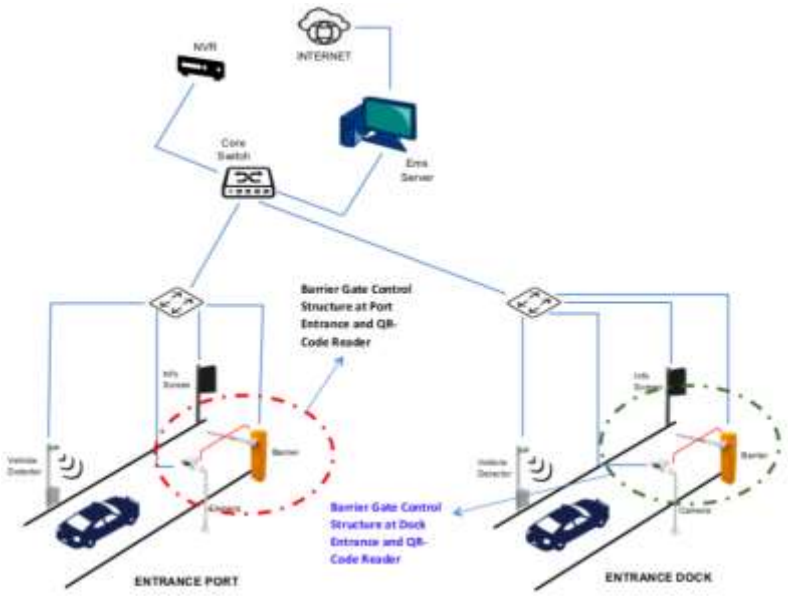

Figure 1. V-MISSQ-port design

V-MISSQ-port barrier gate control structure

Barrier gates or automatic portals are machines for access control of vehicles, be they motorbikes or cars (Sutono *et al.*, 2019). Can be operated This machine manually by pressing the green button to open the bar and pressing the red button to close the bar. This barrier gate can also be accessed using a remote control up to a distance of 30 meters. For this machine to close automatically without pressing the red button, a loop detector or so-called VLD (Vehicle Loop Detector) is needed which is planted right under the crossbar with the aim that after the car/vehicle passes the VLD, the bar will close automatically and as long as the vehicle is in vld area so the bar will not close (safe from being hit by the cross). This automatic portal can also be accessed using an RFID card (Mas Diayasa et al., 2020), be it Mifare, proxy, or UHF. In this study, QR-Code was used to open the bar in the barrier gate. Barrier Gate Control Port (BCP) and Barrier Gate Control Dock (BCD) have the same equipment structure but have different functions, BCP is for the payment process and access to the dock, while BCD functions for the management process for passengers and vehicles going into ship, Figure 2. Shows the structure of the BCD and BCP. Unit Barrier Gate Control Port (BCP) and Barrier Gate Control Dock (BCD) Consists of:

1. CTU (Control Terminal Unit): To control equipment (hardware) and all incoming data from the application
2. Proximity Sensor: To determine the distance of the vehicle that will park, so that it will open the bar on the barrier gate port and dock

3. QR-Code: To scan the QR-Code that is given automatically on the Android-IOS application, so that it will open the bar in the barrier gate port and gate dock for incoming vehicles or passengers
4. Passing sensor: To close the bar after the vehicle has passed
5. Printer: To print parking entry proof
6. Button: for emergency conditions

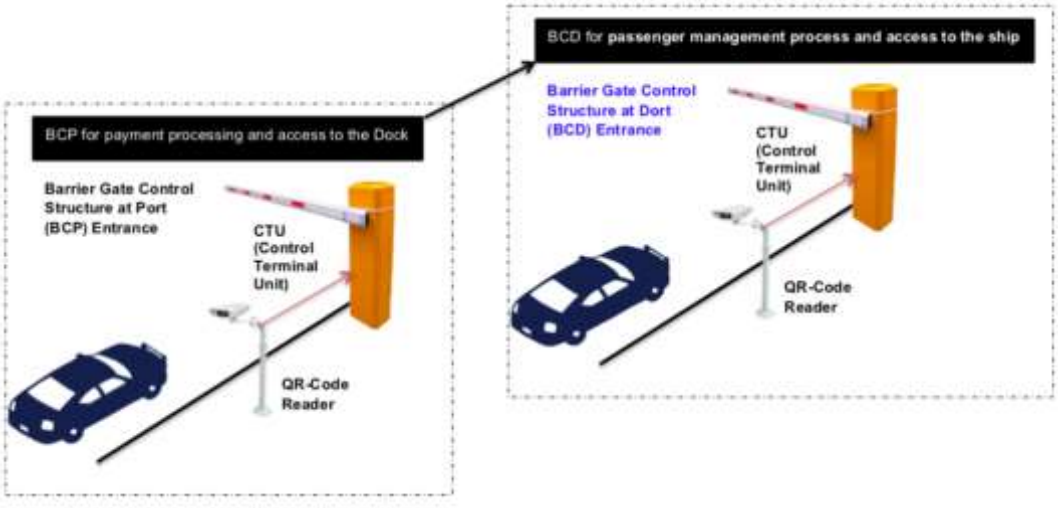

Figure 2. BCD and BCP structure

QR (Quick Response) code (Uzun & Bilgin, 2016) is a trademark for a matrix type barcode (or two-dimensional barcode) which was first designed in 1994 for the automotive industry in Japan. This is a machine-readable type of optical label barcode that contains information about the previously attached item. In practice, QR codes often contain data for identification tools or trackers that will lead to websites or apps (Fauzi et al., 2020). Figure 3 is a few examples of a QR Code.

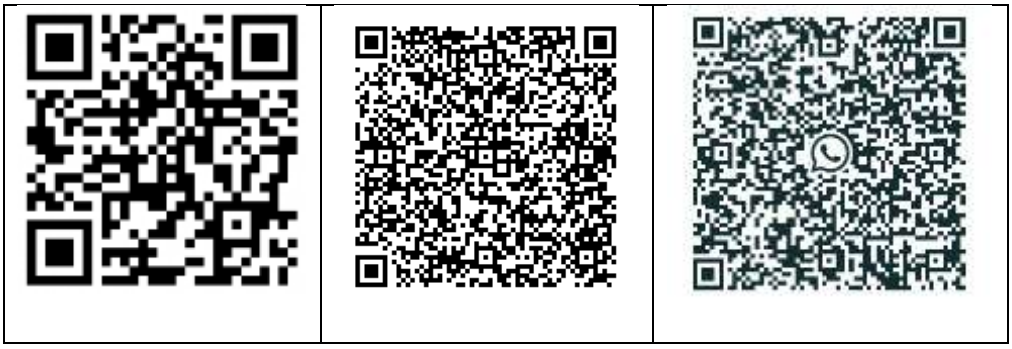

Figure 3. Sample QR Code.

QR codes (Pragna et al., 2017) use four standard coding modes (numeric, alphanumeric, byte/binary, and kanji) and to store data efficiently, can also be used as an extension. Given the Quick Response System has become popular outside the automotive industry due to its fast readability and large storage capacity. More extensive than standard UPC barcodes. These applications include product tracking, item identification, time tracking, document management, and general marketing.s

The QR itself consists of black boxes arranged in a rectangular grid on a white background, which can be read by an imaging device such as a camera, and processed using Reed-Solomon error correction until can be interpreted the image correctly. The required data is then extracted from the existing patterns in the horizontal and vertical components of the image.

IoT and Support Equipment V-MISSQ-Port

Internet of Things (IoT) (Gede Susrama Mas Diyasa et al., 2019) is a concept where an object can transfer data over a network without requiring human-to-human or human-to-computer interaction. IoT has evolved from the convergence of wireless technologies, micro-electromechanical systems (MEMS), and the internet. "*A Things*" The Internet of Things (Mydilee et al., 2017) can be defined as a subject, for example, a person with a heart implant monitor, a farm animal with a transponder biochip, a car that has a built-in sensor to alert the driver when the tire pressure is low. So far, IoT is most closely related to machine-to-machine (M2M) communications in manufacturing and electricity, oil and gas. Products built with M2M communication capabilities are often referred to as smart or "smart" systems. For example, namely smart cables, smart meters, smart grid sensors.

An example is the development of the internet of things that has been and is still possible to be developed again is the internet of things which functions like remote monitoring, this system is one of the most common forms of application systems. One way is to add a sensor to an object that you want to monitor or monitor to determine its existence or even the condition of its layout; the sensor is connected to the internet by adding a mapping or mapping so that can found its position. Thus, what data is needed from the sensor will be obtained, and it can be used to monitor it remotely from the internet network, and can even be directly monitored using a cellphone that supports an internet connection. This research is applied to the registration system of passengers and vehicles entering the port, which will be connected to the payment system and barrier gate opening at the port and dock, as well as to create a management report for passengers entering the ship. Some of the supporting tools for this IoT system include ESP8266 Wi-Fi Module, Relay Circuit Module, and QR-Code Scanner (Mesquita et al., 2018). As in Figure 4.

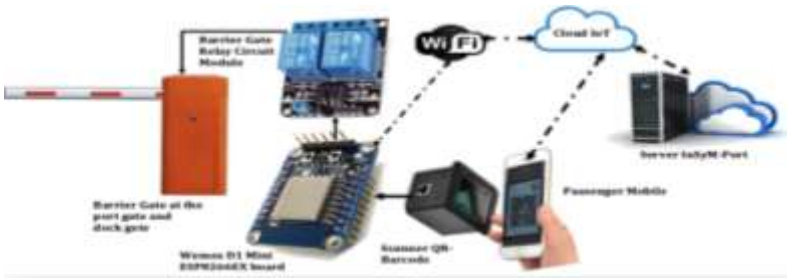

Figure 4. IoT and supporting equipment V-MISSQ-Port

A supporting device that is no less important is the ESP8266 Wi-Fi module which is a Wi-Fi module that functions as an additional device for a microcontroller such as the Arduino so that it can connect directly to Wi-Fi and make a TCP / IP connection. This multipurpose Wi-Fi module is already an SoC (System on Chip) so that research can do programming directly to the ESP8266 without the need for an additional microcontroller. Another plus, this ESP8266 can play the role of both an ad-hoc access point and a client at the same time. The ESP8266 Wi-Fi module (Marco, 2019) used in this study has on-board processing and storage capabilities that allow the chip to be integrated with sensors or with specific appliance applications via input-output pins with only short programming, in this research module it is used to open and close bars. Barrier gate at the

entrance, with integrated low power 32-bit MCU, 0-bit ADC, TCP / IP protocol stack, TR switch, balun, LNA, power amplifier and matching network specifications and Support Smart Link Function for both android and iOS devices.

Unit CMC (Central Management Control) and Android / IOS / WebService applications

This unit functions to regulate all connected devices and records all incoming and outgoing vehicles. AAP is given for free, which can be downloaded from the Android application or on the IOS, which functions as an Id-Personal to enter the gate port and dock. The V-MISSQ-Port software is built by having three different access users, namely Administrators, Operators, and Users, as android-based system users, designed and created using Graph-Ql and Node.Js. (Budiwitjaksono et al., 2020). Thus each user can obtain information following their respective roles, and data integration can be carried out between users, as in Figure 5.

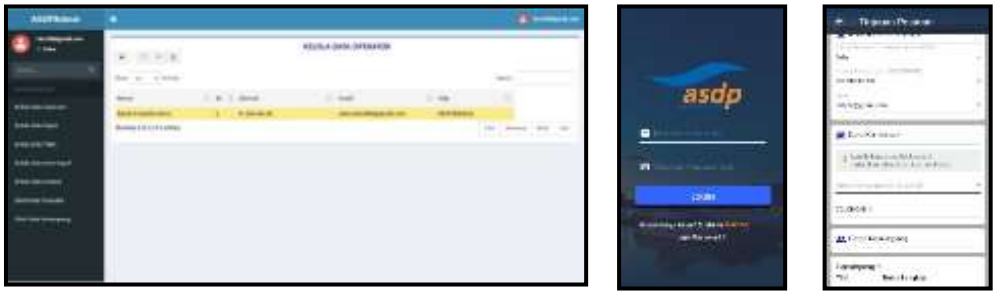

Figure 5. V-MISSQ-Port application display

Results and Discussion

This section will explain the process of testing equipment from the application of the Internet of Things (IoT) for barrier gate control based on android and web, which consists of hardware. CTU (Control Terminal Unit) which has been assembled with a Wi-Fi shield, ESP8266, and relays. After the hardware set has been designed, the next process is to create a project on the cayenne.mydevices.com platform.

Testing the Wi-Fi module ESP8266 Internet of Things (IoT)

The first test is carried out to determine whether or not to connect to the Wi-Fi **module ESP8266** used in this design, which functions as a module for connecting the circuit to the internet network as well as controlling the input and output in the circuit, can be seen the results of this trial in Table 1.

Table 1. Wi-Fi module connection test results ESP8266 with the Internet

No	Wi-Fi name	Connected	
		Yes	Not
1	Kaneshia-1	ok	
2	Azril	ok	
3	igsindonesia	ok	
4	Dakabi home	ok	

The second test on the application of the Internet of Things (IoT) to open and close the barrier gate using the web-based ESP8266 is to provide input manually by pressing the button on the

Cayenne application so that will display the dashboard barrier gate virtualization with the condition of the bar opening or closing. The next process is to perform an automatic test where the QR-Code reader will detect the QR-Code condition when the barrier gate opens or closes, and then will be displayed the data on a visual display on the Cayenne dashboard.

The third test is the application of the Internet of Things (IoT) for open and closes the barrier gate bar using ESP8266 Using the Android OS mobile phone as a control and also as a monitor to find out the barrier gate with the condition of the bar opening or closing by using the Cayenne application visualizing the dashboard display on the Cayenne application will show the results of the barrier gate control process successfully The next process is to test automatically where the QR-Code reader will detect the condition of the QR-Code when the barrier gate opens or closes. The data will be displayed on a visual display on the Cayenne dashboard on an Android phone.

Testing the QR-Code module to the server

In the QR Code reading test and sending to the server, three tests were carried out, namely the first test in a normal position, the second test in an inverted position, the third test with a position not parallel to the QR Code position.

From the QR Code reading test in a normal position, found that ten (10) passengers succeeded in scanning the QR Code in a normal position and 0 passengers failed in the process of opening the barrier gate. Then carried ou the reading test was t in an inverted position. The results were ten (10) passengers who succeeded in scanning the QR Code in the normal position and 0 passengers failed in the process of opening the barrier gate or the same as the standard position QR-Code reading.

The last test is reading with a position not parallel to the position of the QR Code. The results of this test, found that four (4) passengers succeeded in scanning the QR Code in a position parallel to the position of the displayed QR Code, six (6) passengers failed in scanning the QR Code at an angle of 0-30 degrees from the position of the QR Code either on the left or right, can be seen the results this test in Table 2.

Table 2. Readings in a normal position, upside down and not parallel to the QR Code position

No	Passenger Code	QR-Code Test	Expected results	Readout of QR-Code Position					
				normal	Response Time (ms)	upside down	Response Time (ms)	not parallel	Response Time (ms)
1	P-001001		Successfully Opened Cross Barrier Gate	It works	241	It works	189	It works	374
2	P-001002		Successfully Opened Cross Barrier Gate	It works	187	It works	245	It works	413

To be continued

3	P-002021		Successfully Opened Cross Barrier Gate	It works	312	It works	211	Failed	-
4	P-002036		Successfully Opened Cross Barrier Gate	It works	265	It works	321	Failed	-
5	P-002136		Successfully Opened Cross Barrier Gate	It works	211	It works	217	It works	467
6	P-010539		Successfully Opened Cross Barrier Gate	It works	198	It works	310	Failed	-
7	P-210199		Successfully Opened Cross Barrier Gate	It works	209	It works	243	Failed	-
8	P-610399		Successfully Opened Cross Barrier Gate	It works	219	It works	265	Failed	-
9	P-810899		Successfully Opened Cross Barrier Gate	It works	193	It works	306	It works	481

To be continued

10	P-999999		Success-fully Opened Cross Barrier Gate	It works	178	It works	213	Failed	-

Conclusion

The V-MISSQ-Port (Vehicle and Passenger Management Information System Base on QR-Code, at the Port) prototype, is focused on using the supporting equipment, namely the ESP8266 and QR-Code based IoT connection system which is used to open the barrier gate, namely the port entrance for the payment process and the pier entrance for the manifest defacing process, it can be concluded that:

1. Can be connected Connection to the internet using modules ESP8266 in weak or strong signal conditions in one Wi-Fi signal.
2. The primary function of this QR-Code, namely for the process of recording vehicles and passengers (manifest), so that it will make it easier for the harbormaster to make a ship pass for sailing, can be connected between web and android applications if there is a Wi-Fi signal.
3. There is a QR Code reading in a parallel position either normal or reversed, can successfully scan the QR-Code to open the barrier gate to enter the port for payment processing and the dock entrance for the passengers recording process, while the reading position is on the left and right at an angle of 0 -30 degrees, failed QR-Code scanning.
4. In testing the QR-Code scanning process with ten passengers, obtained it was an average time of 237 ms.

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